

EAST Search History

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S1	97	("5712858" "4764026" "5450203" "5886922" "6014032" "6211685" "6211685" "6232143" "3599093" "3848188" "3832632" "4096348" "4312117" "4423376" "4585991" "4786867" "4845426" "4862077" "4887351" "4892122" "4908571" "4934064" "5070297" "5177439" "5189363" "5207585" "5225037" "5228776" "5347145" "5376235" "5380401" "5394100" "5399983" "5486770" "5528158" "5600236" "5600137" "5691570" "5693565" "5773986" "5867032" "5888075" "5953306" "5952843" "5959460" "5982182" "6020747" "6019663" "6023103" "6028437").pn. ("6040700" "6048750" "6059982" "6059982" "6075373" "6096567" "6107813" "6114864" "6121784" "6127831" "6137296" "6160415" "6168974" "6170116" "6201402" "6211960" "6211960" "6229327" "6254469" "6257958" "6287765" "6305230" "6336269" "6417673" "6426638" "6433571" "6468098" "6507207" "6552556" "6590294" "6605951" "6617863" "6617865" "6623345" "6724204" "6759258" "6771084" "6777966" "6900646" "6927079" "7053639" "5561377" "6093930" "6130544" "4800652" "5659255" "5869975" "5973505" "5019771" "5264788").pn.	US-PGPUB; USPAT; USOCR	OR	ON	2006/08/03 14:05
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S3	96	S1 not S2	US-PGPUB; USPAT; USOCR	OR	ON	2006/08/03 14:27
S4	1	"20040217769"	US-PGPUB; USPAT	OR	OFF	2006/11/17 16:00

EAST Search History

S5	11	(US-20040217769-\$).did. or (US-4585991-\$ or US-5693565-\$ or US-6336269-\$ or US-6426638-\$ or US-6617865-\$ or US-6114864-\$ or US-6771084-\$ or US-6551844-\$ or US-6359456-\$ or US-6597187-\$). did.	US-PGPUB; USPAT	OR	OFF	2006/11/17 15:39
S6	0	((die near2 probe) near2 bump) and (thermal or heat\$4) same (exapan\$4 or contact\$4)).clm.	US-PGPUB; USPAT	OR	OFF	2006/11/17 13:23
S7	0	((die near2 probe) near2 bump) and (thermal or heat\$4) same (exapan\$4 or contact\$4)).clm.	US-PGPUB; USPAT	OR	OFF	2006/11/17 13:24
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S9	4	((die near2 probe) near2 bump) and (thermal or heat\$4) same (exapan\$4 or contact\$4))	US-PGPUB; USPAT; USOCR	OR	ON	2006/11/17 15:03
S10	1234	((bump) and (thermal or heat\$4) same (exapan\$4 or contact\$4)).clm.	US-PGPUB; USPAT; USOCR	OR	ON	2006/11/17 13:25
S11	418	((bump) and (thermal or heat\$4) same (exapan\$4 or contact\$4)).ab.	US-PGPUB; USPAT; USOCR	OR	ON	2006/11/17 13:25
S12	2	"20040217767"	US-PGPUB; USPAT; USOCR	OR	ON	2006/11/17 15:36
S13	1	"6984996"	US-PGPUB; USPAT; USOCR	OR	ON	2006/11/17 15:04
S14	102	("5066357").PN. OR ("5225037"). URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2006/11/17 15:11
S15	59	S14 and (test\$4 near (die or chip))	US-PGPUB; USPAT; USOCR	OR	OFF	2006/11/17 15:12
S16	65	S14 and (test\$4 near (die or chip))	US-PGPUB; USPAT; USOCR	OR	ON	2006/11/17 15:12
S17	6	S16 not S15	US-PGPUB; USPAT; USOCR	OR	ON	2006/11/17 15:12

EAST Search History

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S22	84	"5625298"	USPAT	OR	OFF	2006/11/17 17:13
S23	19	"5808474"	USPAT	OR	OFF	2006/11/17 17:13
S24	8	"6292007"	USPAT	OR	OFF	2006/11/17 17:13
S25	16	("5268571" "5475318" "5623214" "5642054" "5773780" "5806181" "5829128" "6060891" "6072321" "6100708" "6143616" "6181144" "6187677" "6379982" "6531327").PN. OR ("6912778").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2006/11/17 17:53
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S27	13	(diorio near mark)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2007/11/19 11:40
S28	14	("5055778" "5513430" "5604446" "5642056" "5804983" "5828225" "6075373" "6359456" "6426636" "6426637" "6426639" "6552555" "6621710").PN. OR ("6984996"). URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2007/11/19 12:11

EAST Search History

S29	3532	324/754.ccls.	US-PGPUB; USPAT; USOCR	OR	OFF	2007/11/19 12:12
S30	999	324/755.ccls.	US-PGPUB; USPAT; USOCR	OR	OFF	2007/11/19 12:12
S31	952	324/758.ccls.	US-PGPUB; USPAT; USOCR	OR	OFF	2007/11/19 12:12
S32	53	S29 and S30 and S31	US-PGPUB; USPAT; USOCR	OR	OFF	2007/11/19 12:40
S33	2534	(die or chip) near probe	US-PGPUB; USPAT; USOCR	OR	ON	2007/11/19 12:26
S34	2229	((die or chip) near probe) and (test\$4 or inspect\$4)	US-PGPUB; USPAT; USOCR	OR	ON	2007/11/19 12:27
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S36	67	((((die or chip) near probe) with (test\$4 or inspect\$4)).ab.	US-PGPUB; USPAT; USOCR	OR	ON	2007/11/19 12:35
S37	1117	(wafer near prober)	US-PGPUB; USPAT; USOCR	OR	ON	2007/11/19 12:36
S38	45	(wafer near prober).ti.	US-PGPUB; USPAT; USOCR	OR	ON	2007/11/19 12:36
S39	32	(wafer near prober).ti. and (die or chip)	US-PGPUB; USPAT; USOCR	OR	ON	2007/11/19 13:14
S40	271	S29 and S30	US-PGPUB; USPAT; USOCR	OR	OFF	2007/11/19 13:29
S41	71	(probe adj2 comprising) near2 (die or chip)	US-PGPUB; USPAT; USOCR	OR	OFF	2007/11/19 12:47
S42	14	("5061033" "5477160" "5807767" "6064213" "6084215" "6400173" "6452411" "6483330" "6527563" "6531335" "6551844" "6559666").PN. OR ("6847218").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2007/11/19 13:01
S43	4719	test adj (die or chip)	US-PGPUB; USPAT; USOCR	OR	ON	2007/11/19 13:21

EAST Search History

S44	511	S43 and 324/754-758.ccls.	US-PGPUB; USPAT; USOCR	OR	ON	2007/11/19 13:15
S45	12	test adj (die or chip) adj (hold\$3 or support\$4)	US-PGPUB; USPAT; USOCR	OR	ON	2007/11/19 13:21
S50	81	("3473124" "4061969" "4244048" "4344033" "4772846" "4777716" "4780086" "4801871" "4937203" "4975079" "5012187" "5128008" "5134638" "5148103" "5172050" "5173904" "5210485" "5224265" "5228502" "5241266" "5279975" "5307010").PN. OR ("5600257").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2007/11/19 14:20
S51	63	S50 and wafer	US-PGPUB; USPAT; USOCR	OR	OFF	2007/11/19 14:20
S52	24	S50 and wafer and (probe adj card)	US-PGPUB; USPAT; USOCR	OR	OFF	2007/11/19 14:20
S59	7447	(plasma with chamber).clm.	USPAT	OR	OFF	2007/11/19 18:29
S60	4140	(plasma with chamber).ab.	USPAT	OR	OFF	2007/11/19 18:29
S61	237	(plasma with chamber).ti.	USPAT	OR	OFF	2007/11/19 18:29
S62	178	S59 and S60 and S61	USPAT	OR	OFF	2007/11/19 18:33
S63	23	("5055778" "5289631" "5513430" "5604446" "5625298" "5642056" "5804983" "5808474" "5828225" "6075373" "6292007" "6359456" "6379982" "6426636" "6426637" "6426639" "6480012" "6551844" "6552555" "6597187" "6621260" "6621710" "7112975").PN.	USPAT	OR	OFF	2007/11/20 10:54
S64	3	(ceramic with probe with card).ti.	USPAT	OR	OFF	2007/11/20 12:03
S65	10	(ceramic with probe with card).ab.	USPAT	OR	OFF	2007/11/20 12:07
S66	48	((semiconductor or silicon) with probe with card).ti.	USPAT	OR	OFF	2007/11/20 12:08
S67	18	((semiconductor or silicon) near2 (probe adj card)).ti.	USPAT	OR	OFF	2007/11/20 12:23
S68	9	(semiconductor with (chip or die) with probe).ti.	USPAT	OR	OFF	2007/11/20 12:23

EAST Search History

S69	18	("5521523" "5604446" "5804983" "5831441" "6005401" "6040700" "6060892" "6084215" "6107813" "6215321" "6246251" "6265888").PN. OR ("6480012").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2007/11/20 13:16
S70	5	((("5153750") or ("5008734") or ("7144759") or ("6975127") or ("6984996")).PN.	USPAT; USOCR	OR	OFF	2007/11/20 13:17
S71	5	((("5159750") or ("5008734") or ("7144759") or ("6975127") or ("6984996")).PN.	USPAT; USOCR	OR	OFF	2007/11/20 13:17



(9) FIG. 2a is a top elevation of the embodiment of the probe card just described in FIG. 3, showing a plurality of signal contacts 38. FIG. 2b is a bottom view of the embodiment of the probe card of FIG. 3, showing a plurality of probe tips 34. Some of the more numerous signal contacts 38 may be connected to more than one probe tip 34. This may allow different tests to be performed without repositioning the probe card or may allow the probe card to be used with multiple testers. It should be appreciated that different circuits, for example having different loads or impedance matching characteristics, might be included in the different connection paths provided by the embodiments of FIGS. 2a and 2b. The probe card 13 and certain of its elements, for instance the signal contacts 38 and any circuits can be manufactured using standard printed circuit board ("PCB") technology. In one embodiment, the signal contacts 38 and circuits (not shown) are made from boron tungsten. In another embodiment, they are made from copper. Other conductive materials having good electrical properties might also be used. The probe tips 34 can be manufactured using standard

Search Result	Value
wafer-level multilayer anger system	324/754
wafer holder	219/444
punched	324/754

EAST Search
Cont. for
10/7/80, 31

FIG. 2

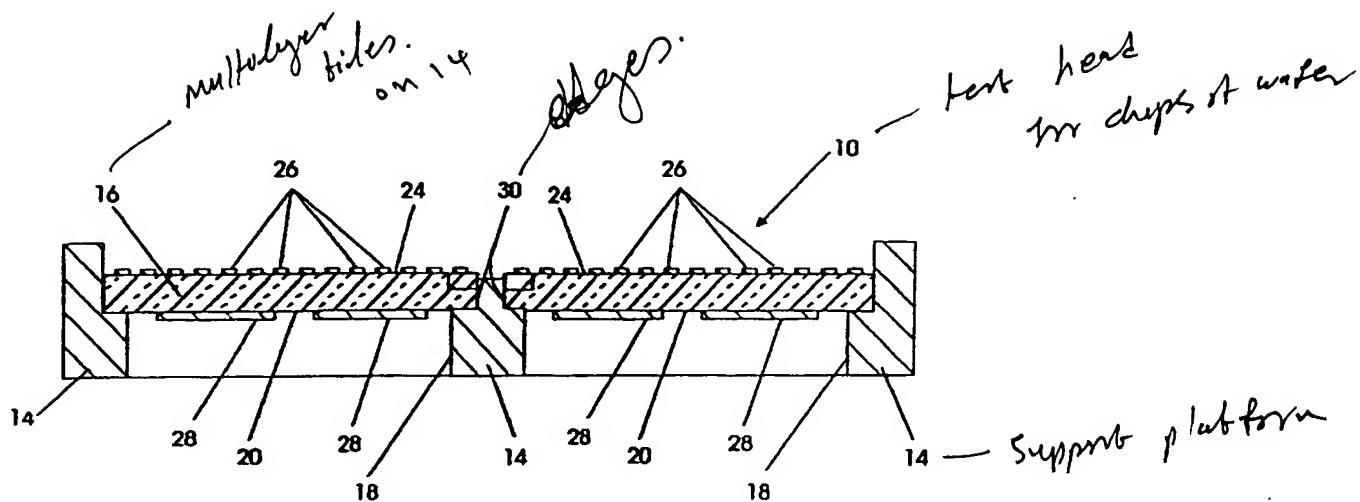
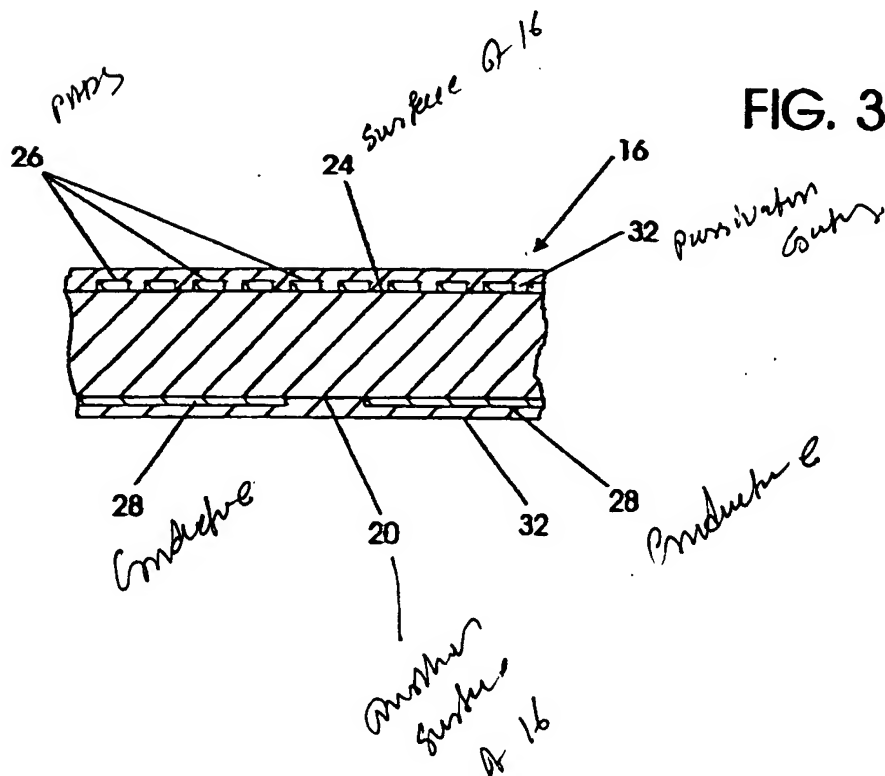


FIG. 3



10-10-68

U.S. Patent

Jun. 6, 2000

Sheet 2 of 4

6,072,321

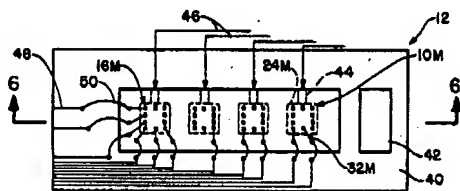


FIGURE 5

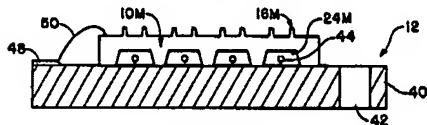


FIGURE 6

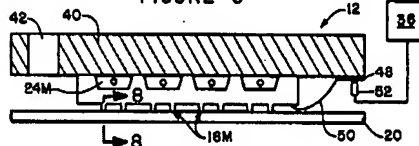


FIGURE 7

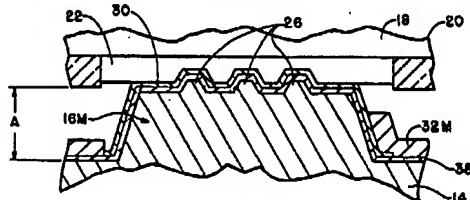


FIGURE 8

as rows of parallel spaced elongated blades. Multiple elongated penetrating projections 26 provide a relatively large surface area for conducting electrical signals to the test pads 22. Although only one penetrating projection 26 is required, with multiple elongated projections 26, current density is spread out and not confined to a small area as occur with a single pointed or conical member.

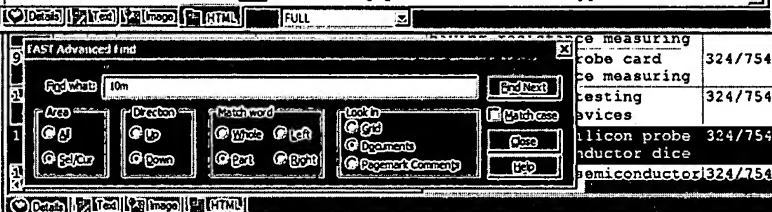
(12) The height of each projection 26 is preferably about 1/10 to 3/4 the thickness of the test pads 22 (FIG. 8). The projections 26 will therefore not completely penetrate the full thickness of the test pads 22, as the upper surface 34 (FIG. 3) of the contact members 16 provides a stop plane to limit the penetration depth. In addition, the height of the projections 26 is selected to allow good electrical contact but at the same time to minimally damage the test pads 22. As an example, the height of each projection 26 measured from the surface 34 of the contact member 16 to the tip of the projection 26 can be about 100-10,000 .ANG.. This compares to a representative thickness of the test pads 22 that is typically the same as a metal bond pad on the order of 2,000 to 15,000 .ANG..

(13) Referring to FIGS. 5 and 6, details of the probe card 12 are shown. The probe card 12 includes a test member 10M and a support member 40. The test member 10M is a monolithic structure substantially equivalent to the test member 10 previously described but adapted to simultaneously test four dice 18 at once. As such, the test member 10M includes four patterns of contact members 16M formed superjacent to four etched cavities 24M. Alternately, the test member 10M can be constructed to simultaneously test from one die to all of the dice on a wafer or an integral die multiple (e.g., 8, 16, 32).

(14) In addition, the test member 10M includes a pattern of conductors 32M in electrical communication with the conductive layers for the contact members 16M substantially as previously described. The pattern of conductors 32M can be formed using a metallization process in a desired pattern and with bonding sites on a terminal end thereof.

(15) The test member 10M also includes etched passageways 44 that are in flow communication with the cavities 24M. The etched passageways 44 are also in flow communication with conduits 46 formed of tubing or other suitable material sealingly attached to the test member 10M. The conduits 46 are in flow communication with a fluid or gas supply (not shown) such that a fluid or gas can be injected into the cavities 24M to produce a variable pressure. With this arrangement the flexure of the contact members 16M can be controlled and varied as required.

(16) The test member 10M is sealingly attached to the support member 40



(13) United States Patent
Chen et al.

(10) Patent No.: **US 6,861,858 B2**
(45) Date of Patent: **Mar. 1, 2005**

(34) VERTICAL PROBE CARD AND METHOD FOR USING THE SAME

2,831,441 A * 11/1998 Matsuda et al. 724/754
6,130,546 A 10/2000 Ardel
6,174,746 B1 1/2002 Watanabe et al.
6,292,009 B1 * 9/2001 Friedrich et al. 724/754
6,619,966 B2 * 9/2003 Matsuda et al. 437/99

(75) Inventors: Hsing-Hsin Chen, Taipei Hsien (TW); Howard Hsu, San Jose, CA (US)

(73) Assignee: SCS Hightech, Inc., Taipei Hsien (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 31 days.

OTHER PUBLICATIONS
K. F. Greene, et al., "Flexible Contact Probe," IBM Technical Disclosure Bulletin, vol. 15, No. 5, p. 1513, Oct. 1972.
* cited by examiner

(21) Appl. No.: 10/351,096

(22) Filed: Jan. 23, 2003

(57) Prior Publication Data

US 2003/0141689 A1 Jul. 31, 2003

(30) Foreign Application Priority Data

Jan. 24, 2002 (TW) 91101112 A

(51) Int. Cl.⁷ G01R 31/02

(52) U.S. Cl. 324/755; 324/761; 324/158.1; 324/754; 257/48

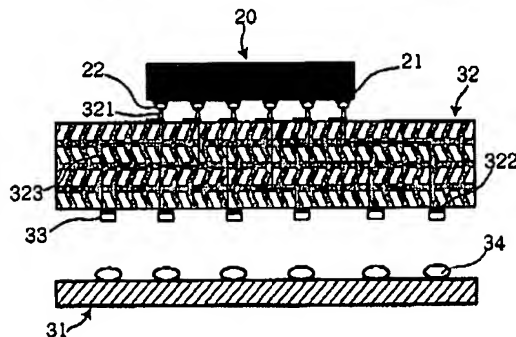
(58) Field of Search 324/755, 761, 757, 761, 158.1, 763, 439/482, 700, 71; 257/737, 738; 438/48, 613, 614, 615; 228/180.22; 174/267, 260, 261; 361/722, 773, 774, 793

(56) References Cited

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5,677,160 A * 12/1995 Low 324/753

13 Claims, 4 Drawing Sheets



US-PAT-NO: 6861858
DOCUMENT-IDENTIFIER: US 6861858 B2
TITLE: Vertical probe card and method for using the same
DATE-ISSUED: March 1, 2005

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Chen; Hsing-Hsin	Taipei Hsien	N/A	N/A	TW
Hsu; Howard	San Jose	CA	N/A	N/A

ASSIGNEE INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
SCS Hightech, Inc.	Taipei Hsien	N/A	N/A	TW	03

APPL-NO: 10/351096

DATE FILED: January 23, 2003

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY APPL-NO	APPL-DATE
TW 91101112 A	January 24, 2002

INT-CL-ISSUED: [07] G01R031/02

INT-CL-CURRENT:

TYPE	IPC DATE
CIPP	G01 R 1/073 20060101

US-CL-ISSUED: 324/755, 324/761, 324/158.1, 324/754, 257/48

US-CL-CURRENT: 324/755, 257/48, 324/158.1, 324/754, 324/761

FIELD-OF-CLASSIFICATION-SEARCH: 324/755; 324/765; 324/754; 324/757; 324/761; 324/158.1; 324/763; 439/482; 439/700; 439/71; 257/737; 257/738; 438/48; 438/613; 438/614; 438/615; 228/180.22; 174/267; 174/260; 174/261; 361/722; 361/773; 361/774; 361/783

See application file for complete search history

EAST Advanced Find

Find what: 32

Area: ☐ All ☐ Up ☐ Down ☐ Left ☐ Right ☐ Match case

Look in: ☐ Grid ☐ Documents ☐ PageMark Comments

Device probe maintaining a probe in card and cing leakage 324/760 324/754

US005172050A

[11] Patent Number: 5,172,050

[45] Date of Patent: Dec. 15, 1992

References Cited

result is provided. The plurality of probe tips are formed on the top surface of the substrate wherein the

10

TITLE: Micromachined semiconductor probe card

Micromachined semiconductor probe card

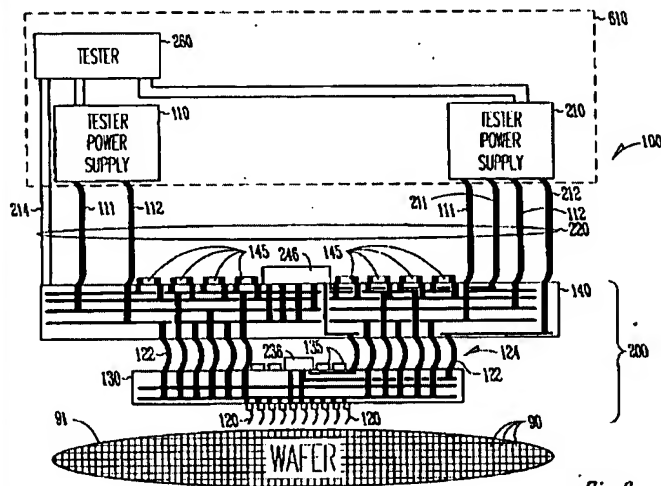


Fig. 2

US-PAT-NO: 6897666
DOCUMENT- US 6897666 B2
IDENTIFIER:

****See image for Certificate of Correction****

TITLE: Embedded voltage regulator and active transient control device in probe head for improved power delivery and method

DATE-ISSUED: May 24, 2005

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Swetten, Tim	Burlingame	CA	N/A	N/A
Pan, Jin	Portland	OR	N/A	N/A
Zhu, Hua	San Jose	CA	N/A	N/A
Ding, Jun	Portland	OR	N/A	N/A

ASSIGNEE INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE	CODE
Intel Corporation	Santa Clara	CA	N/A	N/A	02	
Primarion, Inc.	Tempe	AZ	N/A	N/A	02	

APPL-NO: 10/335195

DATE FILED: December 31, 2002

INT-CL-ISSUED: [07] G01R031/26

INT-CL-CURRENT:

TYPE	IPC DATE
CIPP	G01 R 1/073 20060101

US-CL-ISSUED: 324/754 , 324/765

US-CL-CURRENT: 324/754, 324/765

FIELD-OF-CLASSIFICATION- 324/765; 324/754 ; 324/158.1 ; 324/761 ;
SEARCH: 324/757 ; 324/762

****See application file for complete search history****

LAST Advanced Find

Find what: wafer

Area: ☐ All ☐ Up ☐ Down ☐ Left ☐ Right ☐ Page Mark Comments

Match word: ☐ Whole ☐ Part ☐ Exact ☐ Fuzzy

Look in: ☐ Web ☐ Documents ☐ Page Mark Comments

Match case: ☐ Case ☐ No Case

regulated	324/754
wafer-level	324/754
multilayer	324/758
anger system	324/758
wafer holder	219/444
ounted	324/754
aching	324/754

U.S. Patent

Sep. 9, 2003

Sheet 13 of 14

US 6,617,865 B2

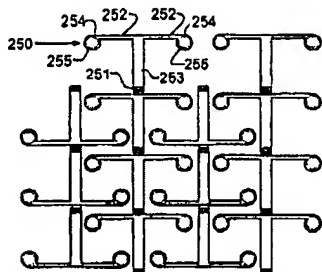


FIG. 17B

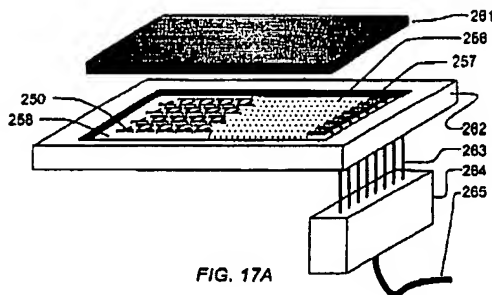


FIG. 17A

(36) FIG. 15B shows a portion of the probes that are disposed on the surface of connector 230. The probe tips are arranged in an area array that is matched to an area array of contact pads on flip-chips being tested. Each probe tip 241 is positioned to mate with a corresponding contact pad on the flip-chip. The dimensions of probe 232 are compatible with a grid pitch spacing of between 150 microns and 500 microns currently utilized for flip-chips. Probes 232 are arranged in a nested pattern that allows each probe to fit the space available. In a preferred embodiment, additional non-functional probes are added to the array to provide support to the wafer under test in local regions where the average density of contact pads on the wafer is low. Any required dimensions are suitable for the invention.

(37) Probe tips 241 of probe 232 provide a hard surface for the purpose of breaking through any oxide on the aluminum bond pads on the wafer under test. Probe tip 241 is disposed at the apex of a "v" shaped elongated thin sheet 242 that is supported by posts 245 joined to contact pads 244 at each end of sheet 242.

(38) Compliant probes according to the teachings of this invention provide a means to test high-speed integrated circuits because of the low self and mutual inductance of each probe. A probe card 249 incorporating compliant probes is shown in FIG. 16A. Probes 240 are disposed in an area array pattern on a substrate 248 suitable for testing flip-chips with area array contact pads. Each probe 240 is connected electrically to terminals 247 on probe card 249 by circuit trace means 246 incorporated in substrate 248. Substrate 248 is preferably made of a dimensionally stable base such as alumina ceramic material, on which circuit traces are disposed between layers of polyimide dielectric material.

(39) FIG. 16B shows an array of compliant probes 240 configured according to the teachings of the invention illustrated in FIG. 5, for example. A probe tip 241 is disposed at the end of extension arm 243 at the midpoint of elongated sheet spring 242. Support posts 244 are joined to contact pads 245 at each end of elongated sheet spring 242 so that probe tip 241 on arm 243 is moveably compliant in a vertical direction.

(40) A chip socket shown in FIG. 17A provides a demountable means for testing, burning-in and operating flip-chips. Flip-chip 261 is held by positioning means 262 such that each contact pad on flip-chip 261 is mated with a corresponding probe 250 on the surface of socket substrate 258. Each probe 250 is connected electrically with terminals 257 on socket substrate 258 by circuit trace means 256. Electrical signals suitable for operating flip-chip 261 are directed to the socket by interconnection means 263 from electronic circuitry means 264. Cable 265 connects the

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	324/754

Probe card - chip socket of 17A

Substrate - 258

probe - 250, 258

Turner - Fig. 17A (inherent to)

Ref. B